

Jan. 1889.

Mr. Marth, Satellites of Uranus.

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Ephemeris of the Satellites of Uranus, 1889. By A. Marth.

Greenwich Noon. 1889.	P	Ariel.			Umbriel.			
		a_1	b_1	$u_1 - U$	a_2	b_2	$u_2 - U$	
Feb. 26	282°643	14°97	8°59	168°62	20°85	11°97	197°03	
Mar. 8	.718	15.06	8.58	157.00	20.97	11.95	345.71	
18	.803	15.13	8.54	145.34	21.07	11.90	134.37	
28	.896	15.17	8.48	133.66	21.14	11.81	283.00	
Apr. 7	282.992	15.19	8.40	121.96	21.17	11.70	71.62	
17	283.085	15.19	8.30	110.23	21.16	11.56	220.22	
27	.173	15.16	8.19	98.48	21.12	11.41	8.82	
May 7	.252	15.10	8.08	86.71	21.04	11.25	157.41	
17	.319	15.02	7.96	74.93	20.93	11.09	305.99	
27	.372	14.93	7.85	63.15	20.79	10.94	94.58	
June 6	.409	14.82	7.75	51.36	20.64	10.80	243.17	
16	.430	14.69	7.66	39.58	20.47	10.67	31.77	
26	.433	14.56	7.58	27.81	20.29	10.57	180.38	
July 6	.418	14.43	7.53	16.04	20.10	10.49	329.00	
16	283.386	14.30	+ 7.49	4.29	19.92	+ 10.43	117.64	
		Titania.		Oberon.				
Greenwich Noon. 1889.	a_3	b_3	$u_3 - U$	a_4	b_4	$u_4 - U$	U	B
Feb. 26	" 34.20 + 19.63	164°71	45°73 + 26°25	321°69		° 790 + 35°02		
Mar. 8	34.40	19.60	218.19	46.01	26.21	229.03	0.853	34.72
18	34.57	19.51	271.65	46.22	26.09	136.37	0.925	34.37
28	34.67	19.37	325.09	46.37	25.91	43.69	1.004	33.97
Apr. 7	34.72	19.19	18.53	46.43	25.66	311.01	1.085	33.55
17	34.71	18.97	71.96	46.41	25.37	218.32	1.165	33.13
27	34.63	18.72	125.39	46.32	25.04	125.63	1.240	32.72
May 7	34.51 + 18.46	178.82	46.15 + 24.69	32.95		1.307 + 32.34		
17	34.33	18.20	232.25	45.91	24.34	300.27	1.363	32.01
27	34.11	17.94	285.70	45.61	24.00	207.60	1.407	31.74
June 6	33.85	17.71	339.15	45.27	23.68	114.95	1.437	31.54
16	33.57	17.50	32.61	44.90	23.41	22.31	1.452	31.42
26	33.28	17.33	86.08	44.50	23.18	289.68	1.451	31.38
July 6	32.98	17.20	139.57	44.10	23.00	197.06	1.433	31.43
16	32.68 + 17.11	193.08	43.70 + 22.88	104.46		1.399 + 31.57		

P, angle of position of the minor axes of the apparent orbits.
 a, b , major and minor semi-axes of the apparent orbits.

$u-U$, orbital longitudes of the satellites reckoned from the points which are in superior conjunction with the planet or in opposition to the Earth.

$U+180^\circ$, planeto-centric longitude of the Earth reckoned in the assumed plane of the orbits from the ascending node on the celestial equator.

B , latitude of the Earth above the plane of the orbits, the ascending node N and inclination J , of which, in reference to the equator of 1880° , are assumed to have the values

$$N = 165^\circ 770; \quad J = 75^\circ 210, \text{ or}$$

for 1889° $165^\circ 898 \quad 75^\circ 198$.

The values of P , a , b , and $u-U$ are to be interpolated directly for the times for which the apparent positions are required, the equation of light being already taken into account. The degrees of the differences of successive values of $u-U$ are in the case of $Ar. 1428^\circ$, $Um. 868^\circ$, $Tit. 413^\circ$, $Ob. 267^\circ$. The position-angles p and distances s are then found by means of the formulæ

$$s \sin(p-P) = a \sin(u-U),$$

$$s \cos(p-P) = b \cos(u-U).$$

The satellites will be at their greatest elongations (N. in position-angle $P+90^\circ$, S. in position $P-90^\circ$) and at their conjunctions (superior conjunction in position-angle P , inferior conjunction in position $P-180^\circ$) with the planet's centre at the following hours, Greenwich mean times:—

Ariel.

N. Elong.		S. Elong.		N. Elong.		S. Elong.		N. Elong.		S. Elong.		
1889. Feb. 27	h 23.3	M. 1	h 5.5	Apr. 9	h 7.1	IO	h 13.4	May 19	h 15.0	20	h 21.3	
Mar. 2	11.8	3	18.0		11	19.6	13	1.9	22	3.5	23	9.8
5	0.3	6	6.5		14	8.1	15	14.4	24	16.0	25	22.3
7	12.7	8	19.0		16	20.6	18	2.8	27	4.5	28	10.8
10	1.2	11	7.5		19	9.1	20	15.3	29	17.0	30	23.3
12	13.7	13	20.0		21	21.6	23	3.8	June 1	5.5	2	11.7
15	2.2	16	8.5		24	10.1	25	16.3	3	18.0	5	0.2
17	14.7	18	20.9		26	22.6	28	4.8	6	6.5	7	12.7
20	3.2	21	9.4		29	11.1	30	17.3	8	19.0	10	1.2
22	15.7	23	21.9	May 1	23.6	3	5.8	11	7.5	12	13.7	
25	4.2	26	10.4		4	12.1	5	18.3	13	20.0	15	2.2
27	16.7	28	22.9		7	0.6	8	6.8	16	8.5	17	14.7
30	5.2	31	11.4		9	13.0	10	19.3	18	21.0	20	3.2
Apr. 1	17.6	2	23.9		12	1.5	13	7.8	21	9.5	22	15.7
4	6.1	5	12.4		14	14.0	15	20.3	23	22.0	25	4.2
6	18.6	8	0.9		17	2.5	18	8.8	26	10.4	27	16.7

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Umbriel.

N. Elong. 1889. Feb. 28				S. Elong. h M. 2 23·6				N. Elong. Apr. 11				S. Elong. h 8·6 13 10·3				N. Elong. May 22				S. Elong. h 19·3 24 21·0			
5	1·3	7	3·1			15	12·0	17	13·8			26	22·7	29	0·5								
9	4·8	11	6·5			19	15·5	21	17·2			31	2·2	J. 2	3·9								
13	8·3	15	10·0			23	19·0	25	20·7			June	4	5·7	6	7·4							
17	11·7	19	13·5			27	22·4	30	0·2			8	9·1	10	10·9								
21	15·2	23	16·9	May	2	1·9	4	3·6			12	12·6	14	14·3									
25	18·7	27	20·4			6	5·4	8	7·1			16	16·1	18	17·8								
29	22·1	31	23·9			10	8·8	12	10·6			20	19·6	22	21·3								
Apr.	3	1·6	5	3·3		14	12·3	16	14·1			24	23·0	27	0·8								
	7	5·1	9	6·8		18	15·8	20	17·5			29	2·5	Jy. 1	4·2								

Titania.

Feb.	26	h 8·9	inf.	Apr.	2	h 4·8	May	7	h 0·7	inf.	June	10	h 20·6
	28	13·1	S.		4	9·0		9	4·9	S.		13	0·8
Mar.	2	17·3	sup.		6	13·2		11	9·2	sup.		15	5·1
	4	21·6	N.		8	17·5		13	13·4	N.		17	9·3
	7	1·8	inf.		10	21·7		15	17·7	inf.		19	13·6
	9	6·1	S.		13	2·0		17	21·9	S.		21	17·8
	11	10·3	sup.		15	6·2		20	2·1	sup.		23	22·0
	13	14·6	N.		17	10·5		22	6·4	N.		26	2·3
	15	18·8	inf.		19	14·7		24	10·6	inf.		28	6·5
	17	23·0	S.		21	19·0		26	14·9	S.		30	10·7
	20	3·3	sup.		23	23·2		28	19·1	sup.	July	2	15·0
	22	7·5	N.		26	3·5		30	23·4	N.		4	19·2
	24	11·8	inf.		28	7·7	June	2	3·6	inf.		6	23·5
	26	16·0	S.		30	11·9		4	7·9	S.		9	3·7
	28	20·3	sup.	May	2	16·2		6	12·1	sup.		11	7·9
	31	0·5	N.		4	20·4		8	16·4	N.		13	12·2

Oberon.

Feb.	27	h 10·4	sup.	Apr.	8	h 20·0	May	19	h 5·6	sup.	June	28	h 15·1
Mar.	2	19·2	N.		12	4·8		22	14·4	N.	July	1	23·9
	6	4·0	inf.		15	13·6		25	23·2	inf.		5	8·7
	9	12·8	S.		18	22·4		29	8·0	S.		8	17·5
	12	21·6	sup.		22	7·2	June	1	16·8	sup.		12	2·4
	16	6·4	N.		25	16·0		5	1·6	N.		15	11·2
	19	15·2	inf.		29	0·8		8	10·4	inf.			
	23	0·0	S.	May	2	9·6		11	19·2	S.			
	26	8·8	sup.		5	18·4		15	4·0	sup.			
	29	17·6	N.		9	3·2		18	12·8	N.			
Apr.	2	2·4	inf.		12	12·0		21	21·5	inf.			
	5	11·2	S.		15	20·8		25	6·3	S.			

Titania and *Oberon* will appear in the same direction from the centre of the planet :—

Mar. 8	17 ^h 8	Apr. 27	0 ^h 4	June 15	7 ^h 1
Apr. 2	9 ^h 1	May 21	15 ^h 7	July 9	22 ^h 4

and in opposite directions :

Feb. 24	10 ^h 2	Apr. 14	16 ^h 7	June 2	23 ^h 4
Mar. 21	1 ^h 5	May 9	8 ^h 1	27	14 ^h 8